Project Introduction

With the advent of the new exploration initiative, the number of customers and missions to be supported by the NASA Space Communications infrastructure will increase dramatically. As well, new antenna types to be developed in support of exploration will increase, thus increasing the complexity of constraints governing the use of space communications assets. In a new concept, the communications architecture will evolve from the present legacy assets but with the addition of new assets. This future architecture will need a radically new user interface paradigm that must allow space communications missions to both unequivocally specify their requests and also iteratively get those requests integrated with those of other users in increasingly crowded bandwidths. It is our contention that such an interface cannot be developed easily with conventional means, but instead is best designed using intelligent agent technologies, resulting in an intelligent space communications scheduling agent for each user/mission. Therefore, to meet the increased scheduling needs we propose to: design and develop software scheduling agents to interface with existing space communications scheduling engines, using local working databases of active schedule possibilities; to incorporate in the agents models of user preferences for communications requests, conflict resolution and notification of schedule changes; to allow the user/mission to vary the autonomy of the scheduling agent; and to imbue the agents with the capability for planful interactions for peer-to-peer resolution of schedule conflicts.

Anticipated Benefits

The military has a number of arenas wherein tasks are requested of limited availability assets. Examples are the Air Force Satellite Control Network (FSCN) and the defense intelligence use of high altitude aircraft and special operations surveillance assets. The needs of the user/missions of these assets are similar and would benefit from the application of our enhanced DCI technology. The military is also currently a large customer for unmanned vehicle operations. Unmanned vehicles, both air and ground, are becoming more and more common in battlefield situations. As these unmanned vehicles are increasingly deployed in tandem with dismounted forces, coordinating software will be necessary to ensure successful operations. In particular, unmanned surveillance vehicles, are becoming more and more common in battlefield situations as evidenced in Iraq and Afghanistan. As these unmanned vehicles are increasingly deployed, scheduling their use by an increasing number of users will require the kind of distributed agent systems described in this proposal. Mission planning will also play a large role in integrated manned and unmanned operations. Distributed planning and control systems will serve to better merge competing user needs to accomplish military missions. Finally, non-military applications include distributed scheduling of aircraft in municipal airports, trains and other transportation systems, as well as factory production lines. Scheduling is a

Intelligent Agents for Scheduling Space Communications, Phase I

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

primary enterprise at NASA and the new exploration initiative will only increase the need for efficient interactive scheduling. Besides space communications, we also see potential applications to assist geographically distributed users to schedule time on NASA's orbital and ground based telescopes. Mission planning is at the core of all space missions due to the high cost of space assets such as astronauts, equipment and communication links. Our new agent services, connected with planning engines, will have applications across many NASA programs, from Mission Control to on-board NASA vehicles and outposts, especially for EVA planning. With the new exploration initiative, EVA mission planning and scheduling will increase dramatically from an EVA every few months to one or two a day, and that will increase the need to integrate science and exploration training tasks into a coherent EVA plan/schedule. We also expect applications of our technology to immediately impact NASA's Exploration Technology Development Program (ETDP), in particular, the Automation for Operations (A4O) managed at NASA ARC, which is investigating automated planning and scheduling to enhance spacecraft operations.

Primary U.S. Work Locations and Key Partners
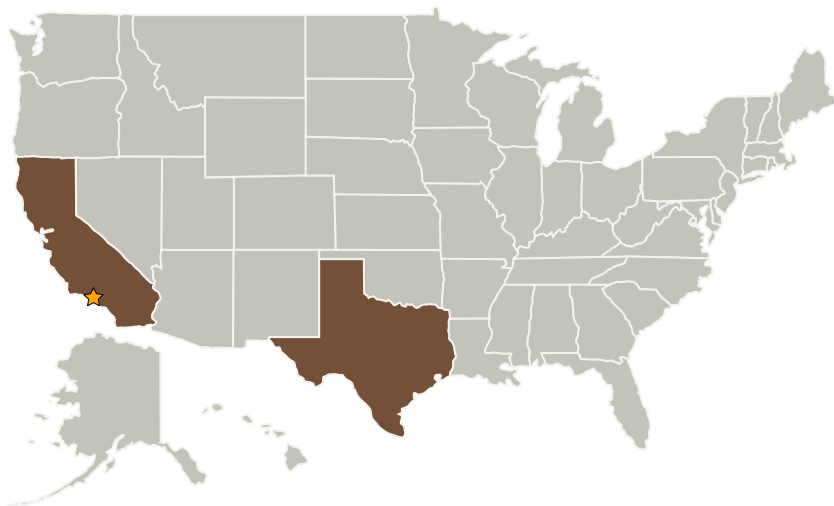
Project Management

Program Director:
Jason L Kessler
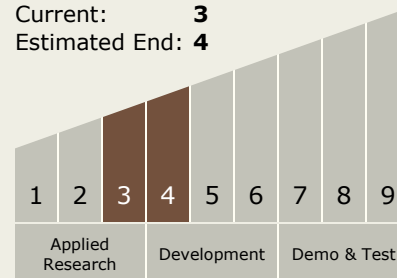
Program Manager:
Carlos Torrez

Project Manager:
Celestino Jun Rosca

Principal Investigator:
Peter Bonasso

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **4**

1	2	3	4	5	6	7	8	9
Applied Research			Development			Demo & Test		

Technology Areas

Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  └ TX17.2 Navigation Technologies
    └ TX17.2.1 Onboard Navigation Algorithms

Organizations Performing Work	Role	Type	Location
⭐Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
TRACLabs, Inc.	Supporting Organization	Industry	Webster, Texas

Primary U.S. Work Locations	
California	Texas